ATMOSPHERIC SCIENCES 749
Fall 2008
ATMOSPHERIC RADIATION

Course Administration: http://www.patarnott.com/atms749/.

Time and Place: Tuesday / Thursday 11:00 am to 12:15 pm, Room 300 Leifson Physics

Main Textbook: A First Course in Atmospheric Radiation: Second Edition, by Grant W. Petty.

This course will be taught by W. Patrick Arnott. Office / lab hours Tues and Thurs 12:30 - 2 pm, or by appointment.

TOPICS IN BRIEF:

Solar and terrestrial radiation spectra
Radiative transfer in the atmosphere (absorption, scattering, extinction)
Basic radiation laws
Equation of the radiation transfer
Representation of the atmospheric radiation in terms of the electromagnetic theory
Polarization of light
Rayleigh Scattering
Mie Scattering
Theory of multiple scattering for a simple 1-D atmosphere
Spectral properties of the longwave radiation in the atmosphere
Passive and active remote sensing methods
Earth radiation budget
Radiative forcing by gases, aerosol and clouds
Role of radiation in global climate modeling

Final examination: Thursday, 11 Dec 2008– 7:30 - 9:30 a.m.

Contact: P. Arnott can be reached at patarnott@physics.unr.edu, 775-784-6834 (office) 233-2601 (cell).

Grades: Midterm=30%. Homework=50%. Final=20%.

Policy on late homework: Late homework is not accepted except when circumstances warrant it.

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The specific plan for the course is to organize our thoughts in the same order as the book chapters, with homework problems from the text and other sources. Written solutions for homework problems should be complete, with first a statement of the problem to be solved, then the problem solution. Wait, you are not done yet. The final and most important component is your interpretation of the problem solution -- what does it mean? Why did you do this problem? What did you learn?

For the homework, it is wise to work with others. As a group you will gain much more insight and skill than as an individual. both in the class, and later in life when you go on to other pursuits. In the end, make your solution a unique expression of your understanding of the problem after you have thoroughly come to grips with it.

Homework problems will be graded as follows:
Completeness: 50%
Correctness: 40%
Creativity and Challenge: 10%

Electromagnetic radiation is the most fundamental energetic component of climate. Satellites do their jobs with electromagnetic radiation. The Earth/Sun distance and solar output are fundamentally important for life and these parameters peg the Earth as more of less a habitable planet at 255 K from an extraterrestrial perspective. As we crawl the Earth we can appreciate the surface warmth brought to us by infrared radiation emitted to the surface by atmospheric gases and clouds. In this class it is fair game, indeed essential, that we consider how the sun works, the color of water, plants, soil, snow, the sky, clouds, and the life cycle and transformation pathways for electromagnetic radiation.

The textbook for this course is a solid introduction to the subject. Class meetings will often veer from the exact content of the book so that you experience a variety of perspectives. Measurements of solar and infrared radiation will be a central feature in this course as well so that you have an optimal feel for the subject.

The book has 13 chapters and 458 pages. We have 15 weeks more or less, so we will aim for completing each chapter, on the average, at a pace of just over a week per chapter. The tools you will find helpful for this class include of course a sharp, keen intellect, but also a keen sense of observation for the roles of electromagnetic radiation in meteorology. Look often at the sky and at clouds, and use your digital camera to take pictures of interesting atmospheric optics events. Share these pictures, and their interpretation with everyone in class. Look also at the ground and note how its albedo changes from day to day, season to season. Try to imaginie what the world would look like if you could tune your eyes to see UV and IR radiation. Envision how our optical displays like rainbows would be different if our hydrometeors fell to the ground on planets with more or less gravity.

Use the opportunity of this semester to understand the beauty, subtlety, and fundamental character of electromagnetic radiation in nature.